## REMARKS

In a non-final Action mailed 6 September 2006 the Examiner rejected claims 1-3, 10-12 and 14 under 35 USC 102(a). Claims 4-9, 13 and 15 were rejected under 35 USC 103(a) for obviousness.

Minor amendments to the specification have been made. The proposed change to paragraph [006] is believed to be trivial. The changes to paragraph [0022] are more substantive. The first substantial change, following insertion of a definite article, involves deletion of an extraneous clause and an immediately subsequent sentence fragment which seem inconsistent with the main body of the sentence. The second change deletes an incomplete example. The changes to not relate to material needed for understanding of the invention and no new matter is introduced by the changes. The deleted reference to 6" inch diaphragms should be unexceptional since that was merely an example of a common diaphragm size.

Claims 1, 2 and 10 have been amended. Claim 1 has been amended to distinguish over the art more distinctly. Claim 10 has been amended for the sake of clarity and to de-emphasize the importance seemingly placed on the transducers. Claims 1-15 remain active.

Claim 1 was rejected as anticipated by Danley, US-P 4,845,759 ("Danley I"). We disagree with the Examiner that "Danley discloses a loudspeaker comprising: and enclosure including a *folded* horn having a mouth (fig.4#48) . . ." (emphasis added). A folded horn is one of the explicit limitations of both the original and amended claim 1. While Danley shows a horn, it is not a folded horn as that term is used in the art.

Horns are not equivalent to folded horns as an acoustic structure. Normally there is no particular acoustic advantage to be gained from "folding" a horn. It is done to reduce overall size of the structure despite the additional disadvantages it has even compared to the distortion introduced by a straight horn. As stated by Leo L. Beranek in his text "Acoustics" (McGraw-Hill Book Company, 1954) at pages 278-9: "In order to be successful, the bends in folded horns must not be sharp when their lateral dimensions approach a half wavelength, or they will change the spectrum of the radiated sound." He continued: "It is seen that when a duct (and by analogy a horn) width is near one-half or three-halves wavelength the attenuation of the sound by a 90° bend is quite large. At high frequencies, the losses for even 19° bends are large. If possible, the wavelength should be long compared with te width of the duct at the bend. Then the attenuation is very small." Thus folded horns are favored for low frequency applications.

Clearly Danley would have avoided use of a folded horn. He intended his system for use up to 20 KHz, the usual upper limit of human hearing, which is universally regarded in the acoustic arts as a high frequency. See Danley I, col. 4, lines 8-11. But as is clear from Beranek, the use of folds in high frequency devices is disparaged.

Claim 1 has been amended to distinguish the character of the spacing of the acoustic ports feeding the horn as done in the invention, and the differential spacing of transducers taught by Danley I and shown by Danley in his Fig. 2. Danley Fig. 2 is an example of what is in effect a staggered or curved line array (see col. 2, lines 59-60). While the transducers are staggered, the spacing between transducers remains critical, as is true of conventional line arrays. As Danley himself puts it, ". . . the effective size and spacing between the sound sources along the line is also critical. The spacing and effective size in this direction must be such as to allow adjacent sound dispersion

patterns to overlap and complement each other." (Danley I, Col. 2, lines 33-37).

Though Danley I shows a horn in Fig. 4, it is unclear from Danley I that he intended to use the staggered/curved linear array of Fig. 2 with the horn. The language of the reference is elective, stating only that "the line of sound sources may be arranged in *the* throat of a single horn" (emphasis added), and the drawing shows its use only with an unstaggered array. Clearly all of the sound sources in Danley I, Fig. 4, are shown directed into a single throat. The original claim required a throat for each transducer and the claim as amended makes it clear that this is a requirement for a plurality of throats which in turn are directed into a "summing section" or "summing throat". Fig. 6 of Danley I shows a plurality of throats feeding a single horn, but the output ports of the throats are not acoustically differentially spaced from the mouth of the common horn. Danley I simply doesn't show or teach enough structure to simultaneously meet the requirements of both a plurality of throats and a distinct summing throat, much less the structural requirement that the throats be "acoustically spaced" to feed the summing throat from the base end of horn forward toward its mouth. Even if Danley I were taken to imply that a staggered linear array was to be used with a horn it is unclear what could be taken as the horn's base end other than the points where the transducers are coupled to the horn. The sound waves from all of the sound sources are merged at the same time along a line in front of the line array. The sound waves do not cascade.

Sound wave front reinforcement in the present invention was not concerned with generating constructive interference based on the dispersion patterns of radiators set in a linear array. The present invention is directed to an apparatus which gains efficiency at low frequency at the cost of band width (see paragraph [0027]) and which can absorb a high level of input power (see paragraph [0022]) by cascading the inputs of a plurality of transducers. The operation of the system of the invention is spelled out at paragraph

[0028] where it states "that acoustic pressure waves from the outlets of [the] extended throats [are] synchronized at the points where they merge.", which, as seen from the figures, progresses from the base of the horn outward to the mouth. The acoustic outputs of each transducer are added sequentially in a way that they reinforce each other, or, as put in the application, "The signal for the transducer associated with the throat radiating end removed by the greatest distance from mouth 12 is delayed least, while the signal driving the transducer associated with the throat radiating end closest to mouth 12 is delayed by the greatest period" (see paragraph [0028]). The outputs from the radiating ports build in a cascade, that is the cumulative output of prior stages feeds each subsequent summing stage in series. (The term "cascaded" is defined in the McGraw-Hill Dictionary of Scientific and Technical Terms, Sixth Edition, page 337, as "Of a series of elements or devices, arranged so that the output of one feeds directly into the input of another . . ."). The title of the present application included the term "Cascaded Linear Array", which was intended to functionally distinguish the present invention from conventional linear arrays.

"Cascaded Linear Array" is apt as a characterization of the output of the invention. Although at the time of making the application it was thought that the transducers probably should be arranged in a line, and the application states that such an arrangement was preferred, the application very carefully did not require such an arrangement. See paragraph [0006] and compare original claim 10 to claim 12 or original claim 1 to claim 7. A key distinction in the cascaded array is that the wavelengths of the sounds are not a consideration in determining a fixed maximum allowable spacing between the output ports into the summing section of the horn. The application describes no maximum allowable spacing.

The language of claim 2 has been amended to more clearly define that the outputs of the transducers are cascaded or summed in sequence. The claim as

amended now provides in pertinent part:

> transducer drive signal processing circuitry having an individual channel for each of the audio transducers, the individual channels each being coupled to receive the acoustic range signal and each channel including a time delay element for delaying a signal in a channel as a function of the acoustic spacing of the throat for the audio transducer associated with the channel from the mouth of the folded horn to build an acoustic pressure front which builds in a cascade toward the mouth.

Claim 3 adds the limitation of a high pressure chamber between each transducer of claim 1 and the throat connecting the transducer to the summing throat. The applicant disagrees that Fig. 6 of Danley I shows such high pressure chambers. The structure indicated as meeting the "chamber" limitations are called "throats" by Danley. A chamber is distinguished from a port or throat by having an outlet which is relatively constricted to the volume. A combustion chamber for a rocket would, for example, extend along the convergent portion of an outlet nozzle. The structure identified in Danley as a chamber appears from the drawing to be continuously expanding. Our use of the term chamber, particularly a "high pressure chamber" might also be called a front end ported enclosure. It necessarily includes a restricted outlet relative to its dimensions.

With respect to the anticipation rejection of claim 10, also based on the Danley I reference, we again disagree that Danley shows "high pressure chambers" for the reasons given above with respect to claim 3. We disagree that the Danley I, fig. 6,shows extended ports between high pressure chambers and a summing throat. A port is a acoustic structure which operates as a second diaphragm and thus should have a constant cross-sectional area along the entire length of the port. The "throat" structures shown in Danley I appear to a have increasing cross-sectional areas. To

emphasize the point in the pending claims the ports are now explicitly required to have a constant cross-sectional area. There is no structure in Danley I corresponding to juncture of the ports with a summing sections displaced forward from the base end of the horn.

Regarding the Ohta US 2001/0016045 application, it should be sufficient to observe that the system relates to adjustment of a sound field in a relatively free field environment. The transducers are not horn loaded using the same horn. Producing an effect at a particular point in an environment is not the same problem as producing a source which can radiate acoustic energy in a particular way.

Danley, US 6,411,718 was accurately described as teaching sealed back chambers and provides a motivation for their use. The reference does not overcome the basic omissions of the primary reference though.

The remaining dependent claims recite still further elements distinguishing the invention over the prior art. Lyons teaches spatially mounting a pair of divergent sound passages leading to the front of a vehicle for a siren. Thomas is not directed to a sound system supporting cascaded summation of the generated sound.

Applicant believes the Claims are in condition for allowance and respectfully requests favorable action by the Examiner.

Respectfully submitted,

Date: 27 December 2006
Fort Wayne, Indiana
Tel. No. 260.407.3907

Paul W. O'Malley
Attorney for Applicant
Reg. No. 31,048